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CALSPAN ADVANCED TECHNOLOGY CENTER

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DATA Quarterly Report, 23 Aug. - 23 Nov.
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APPLICATIONS OF HCMH SATELLITE DATA

Contract No. NAS5-24263

Thirteenth Quarterly Report

8/23/80 - 11/23/80

Prepared for:

NASA Goddard Space Flight Center
Greenbelt, Maryland 20771

A DIVISION OF CALSPAN CORPORATION

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1981

SIS 19026

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Type II

Objectives:

The objectives of this investigation are to study the thermal properties of Great Lakes, Erie and Ontario, as they relate to water quality, lake hydrology and energy exchange; to study the urban heat island problem in selected areas adjacent to these lakes; and to refine techniques required to obtain accurate surface radiometric temperatures.

Problems:

No significant problems this reporting period.

Accomplishments:

Efforts this reporting period have been directed in all three major program areas and considerable advances were made in each area.

Satellite Sensor Calibration

Satellite Sensor calibration against underflight ground truth was completed during this reporting period. Table 1 contains a listing of calibration results. Initial comparison with atmospheric models has been initiated during this reporting period and will continue to program completion.

Thermal Bar Studies

Uncalibrated maps of observed isotherms for Lake Ontario at two study dates during the thermal bar and at a date in mid-July 1978 have been generated. The July 13th HCMM satellite scanner data indicate apparent thermal anomalies along the north shore of Lake Ontario. The unexpected thermal configuration was considered to be an additional demonstration case for mapping thermal water quality from HCMM data.

Calibrated maps of observed isotherms for the study dates are presently being generated and are expected to be available for the next progress report.

Landsat data for 14 June 1978 from Bands 4 and 5 were processed to generate maps of Lake Ontario water quality along near shore areas. The water quality maps consist of turbidity indicator gray scales, and indicate spatial variation in turbidity associated with the thermal bar. These maps have not, as yet, been calibrated with ground data.

As described in the last progress report, a method for determining variability in Landsat exposure due to atmospheric effects has been devised. The method was used to generate the 14 June Landsat water quality maps, although atmospheric effects were determined to be insignificant in the target areas of the scene. The method has been successfully tested, however, on Landsat imagery from 26 May 1978, where atmospheric interference is much more pronounced.

Analysis of underflight color photography using the method described by Piech and Schott (1979) indicated significant algal increases on the near-shore side of the bar. This was corroborated by Canada Center for Inland Water (CCIW) data taken at the same time.

Heat Island Phenomena

As indicated in the previous progress report, thermal patterns of several urban areas have been generated from HCMM tapes and scaled to corresponding land use maps. The land use maps have since been judged inadequate for teaming with the thermal overlays due to difficulties in determining ground cover types; particularly for determining the extent of vegetative cover such as trees. Therefore, photographic coverage of the urban areas was ordered. High altitude U-2 infrared photographs of Buffalo, Rochester and Syracuse, in both print and transparency formats, are expected to arrive shortly.

HCMM Investigators Meetings (November 14-16, 1980)

A complete program briefing has been prepared for the HCMM review meeting.

HCMM CCT Listing

Table 1 is an updated listing of HCMM CCT's currently in-house at Calspan. The listing includes tapes of registered scenes for June 6, 1978, which arrived during the reporting period.

Significant Results

1. The HCMM thermal sensor was fully calibrated for several underflight dates.
2. Actual surface water temperature maps have been generated for all of Lake Ontario using the calibration procedure mentioned above.
3. Major water quality changes associated with the thermal bar as located by HCMM thermal data have been observed from satellite and aerial data and verified by ground truth.

TABLE I

ICM ATMOSPHERIC CORRECTIONS

	Aircraft ALT X1000'	τ	Slant Range	Ground Temp. to Satellite Coefficients		Air Temp	Visibility (mi.)
				m	b		
<u>5-22-78 Day</u>							
Rochester	8	.73	644	-	-	66	10
Syracuse	4	.773	673	-	-	70	20
9 Mile	8	.69	666	.69	-3.12	-	-
Olcott	4	.73		.64	-2.66	-	-
<u>6-6-78 Day</u>							
Syracuse	4	.708	620	-	-	71	20
9 Mile	4	.653	620	.653	-.572	-	-
<u>6-6-78 Night</u>							
Buffalo	6	.71	620	.708	.202	57	7
Rochester	4	.87	622	.659	-1.231	56	8
Syracuse	4	.87	638	.694	-.629	54	10
<u>8-14-78 Day</u>							
Rochester	6	.68	657	.684	13.41	91	7 (Haze)
Syracuse	6	.62	633	-	-	86	5 (Haze)
<u>11-1-78 Day</u>							
Syracuse	6	.712	637	-	-	53	20

TABLE 2

LISTING OF CCT'S FOR HEAT CAPACITY MAPPING MISSION (HCMM) PROGRAM - 8 December 1980
(Includes Registered Tapes)

<u>Tape Inventory Control No.</u>	<u>Scene Ident. No.</u>	<u>Imagery Description</u>	<u>Targets Covered</u>
<u>HCMM Tapes</u>			
RP 6912H	AA0026 18490-1 " " -2	22 May '78 Day/VIS (027) " Day/IR (028)	Buffalo, Rochester, Syracuse, L. Ontario " " "
	AA0026 18500-1 " " -2	22 May '78 Day/VIS (025) " Day/IR (026)	Lake Ontario " "
RS 0478A	AA0026 18490-1 " " -2	22 May '78 Day/VIS (038) " Day/IR (039)	All Targets Clear (scene reformatted from RP 6912H to include all targets in one scene)
RS 6260G	AA0190 18020-1 " " -2	2 Nov. '78 Day/VIS (003) " Day/IR (004)	Rochester, Syracuse, L. Ontario
RU 8303I	AA0110 18140-1 " " -2	14 Aug. '78 Day/VIS (105) " Day/IR (106)	Rochester, Syracuse, L. Ontario
RP 6118E	AA0041 07360-3	6 June '78 Night/IR (243)	All Targets Clear (scene apparently requires two tapes - see RM 2011K)
RM 2011K	AA0041 07360-3	6 June '78 Night/IR (243)	All Targets Clear (scene apparently requires two tapes - see RP 6118E)
QL 5109F	AA0041 18310-1	6 June '78 Day/VIS (011)	All Targets Clear (transparency shows inter- ference line running through Rochester and southern shore of Lake Ontario near Rochester)
	AA0041 18310-2	6 June '78 Day/IR (012)	All Targets Clear
RT 1628A	AA0078 07250-3	13 July '78 Night/IR (024)	All Targets Clear
CL 0769H	AA0153 07200-3	26 September '78 Night/IR	All Targets Clear (recommend checking tape lead to verify description)
	AA0153 18160-1	26 September '78 Day/VIS (050)	All Targets clear
RW 4963C	AA0153 18160-2	26 September '78 Day/IR (051)	All Targets clear

TABLE 2 (cont.)

LISTING OF CCT'S FOR HEAT CAPACITY MAPPING MISSION (HCMM) PROGRAM - 8 December 1980
(Includes Registered Tapes)

<u>Tape Inventory Control No.</u>	<u>Scene Iden. No.</u>	<u>Imagery Description</u>	<u>Targets Covered</u>
<u>HCMM Tapes</u>			
A 59766	AA0041 07310-6	6 June '78 Day/VIS*	All Targets Clear
	" " -7	" " Day/IR*	"
A59767	AA0041 07310-8	" " Night/IR*	"
	" " -4	" " Temp. Diff.*	"
A59775	AA0041 07310-5	" " Thermal I.*	"
SD 1909B	AA0153 07160-6	26 September '78 Day/VIS*	All Targets Clear
	AA0153 07160-7	26 September '78 Day/IR*	All Targets Clear
SD 1915F	AA0153 07160-8	26 September '78 Night/IR*	All Targets Clear
	AA0153 07160-4	26 September '78 Temp Diff*	All Targets Clear
SD 1547K	AA0153 07160-5	26 September '78 Thermal I.*	All Targets Clear

* Registered